Tailoring HfO_x ReRAM Switching Through Ti Interfacial Engineering

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Resistive random-access memory (ReRAM) is a promising non-volatile memory technology, offering a simple metal–insulator–metal (MIM) structure, low power consumption, and fast switching speed. Among the many resistive switching materials investigated, hafnium oxide (HfO_x) stands out due to its excellent scalability and full compatibility with complementary metal–oxide–semiconductor (CMOS) processes. In HfO_x-based ReRAM, switching behavior is highly sensitive to the metal/oxide interface, where electrode materials can influence oxygen vacancy generation and govern conductive filament formation. As a result, interface engineering has become a key strategy for optimizing device performance.

In this work, we investigate the role of the Ti/HfO_x interface in HfO_x-based ReRAM devices, where titanium serves as both an active electrode and an interfacial modulation layer to tailor resistive-switching behavior. The influence of Ti thickness and post-deposition thermal annealing is systematically evaluated through current–voltage (I–V) measurements, focusing on forming voltage, set/reset characteristics, and resistance-state stability. The high-resistance-state (HRS) to low-resistance-state (LRS) ratio is extracted and compared across device configurations to identify performance trends.